

# First record of the family Pseudocerotidae (Platyhelminthes, Polycladida, Cotylea) from the Persian Gulf, Iran

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## Abstract

In this paper, two species of cotylean Platyhelminthes are recorded for the first time from Qeshm Island, Persian Gulf, Iran. Pictures are taken from living specimens to illustrate shape and colour, and stained sections and drawings are used to describe shape and organisation of some organs. Morphological characters of Persian Gulf specimens of *Tytthosoceros lizardensis* Newman and Cannon 1996 are compared to those of the type specimens of this species.

## Keywords

Platyhelminthes, new records, Qeshm Island, Persian Gulf, Iran

## Introduction

Most polyclad flatworms inhabit coral reefs in tropical and subtropical waters, and are especially species-rich throughout the Indo-Pacific. They are found from the littoral to sublittoral zone, and are often associated with other invertebrates (Bolaños et al. 2007). The order Polycladida is divided into two groups, Acotylea, which lack a ventral sucker, and which is not recorded from the area until now. The second group Cotylea is characterised by possession of a ventral sucker. Among Cotylea, the family Pseudocerotidae contains many conspicuous and colorful species. The diversity of this group, however, is not well known,



because their collection, handling, and identification are difficult (Hyman 1954, 1959; Newman and Cannon 1994a, b, 1996a, b, 1997, 1998, 2000, 2002; Newman et al. 2003)

The two pseudocerotids species *Tytthosoceros lizardensis* and *Thysanozoon* sp. have been reported from reef crests and slopes of Queensland and the Great Barrier Reef (Australia) (Newman and Cannon 1996), and were also mentioned in a multimedia CD on flatworm diversity (Newman and Cannon 2005) as being known from Indonesia, the Philippines, and South Africa. To date, there has been no record of these species from the Persian Gulf and the Gulf of Oman, or other parts of the northern Indian Ocean. In fact, little is known about the diversity and biology of free-living flatworms from this region, and only a few species have been briefly mentioned by Newman and Cannon (2005) from the Gulf of Oman.

To close this gap in our knowledge, we carried out a study on the intertidal polyclads of Qeshm Island located in the Strait of Hormoz between the Persian Gulf and the Gulf of Oman (Fig. 1). Among other flatworm species, members of the family Pseudocerotidae were very conspicuous and are here reported for the first time from the Persian Gulf.

## Material and methods

Sampling was carried out during six field trips (November and December 2007, January, May, July and November 2008 ) from 14 locations along the intertidal zone of the, Persian Gulf, Iran (Fig. 1, Table 1). Flatworms were hand-collected and kept in separate sampling containers, and then brought back alive to the laboratory. However, most specimens autolysed during sampling or during fixation. The remaining specimens were photographed in vivo, fixed on frozen 10% buffered formalin, for at least 24 hours, and then transferred into 70% ethanol for preservation (Bolaños et al. 2007).

Whole-mounts were stained with acetic Carmine, dehydrated in a graded alcohol series and mounted on microscopic slides using Canada Balsam. Some specimens were embedded in Paraffin, and 5µm sagittal serial sections were obtained to study the reproductive system. Sections were stained with Mayer's hematoxilin and eosin (Humason 1972). Sections and whole mounts were studied under a compound microscope (ZEISS, Axioplan2, 459312), and a stereomicroscope (Wild, Herbrugg, 124074), respectively. Drawings and measurements were carried out with aid of a camera Lucida.

Specimens are deposited at the Zoological Museum of University of Tehran collection (ZUTC).

## Results

Three hundreds ninety-nine specimens belonging to five different families of polyclads were collected, of which 80 specimens belonged to Pseudocerotidae. Those specimens were identified as belonging to the genera *Tytthosoceros* and *Thysanozoon*.





**Figure 1. A** Location of the Qeshm Island between the Persian Gulf and the Gulf of Oman **B** Sampling locations.

**Table 1.** Coordinates and types of Sampling locations.

No.	Coordinates		Habitat
1	N 26° 56' 3.9"	E 56° 16' 29.8"	Rubble - Rocky
2	N 26° 45' 40.9"	E 55° 54' 52.9"	Rocky
3	N 26° 43' 58.59"	E 55° 50' 52.7"	Sandy
4	N 26° 38' 23.5"	E 55° 36' 1.7"	Sandy - Rubble
5	N 26° 34' 19.8"	E 55° 23' 49.5"	Sandy - Rubble
6	N 26° 33' 54.1"	E 55° 21' 48.4"	Sandy
7	N 26° 39' 8.6"	E 55° 15' 9.8"	Rocky
8	N 26° 43' 53.3"	E 55° 35' 46.4"	Muddy
9	N 26° 57' 3.0"	E 55° 45' 56.2"	Muddy
10	N 26° 56' 15.1"	E 55° 58' 3.0"	Sandy - Rubble
11	N 26° 54' 50.6"	E 55° 56' 14.9"	Muddy
12	N 26° 59' 36.3"	E 56° 13' 3.2"	Sandy - Rocky
13	N 26° 58' 27.9"	E 56° 15' 7.3"	Muddy - Rubble
14	N 26° 58' 36.4"	E 56° 15' 53.3"	Muddy - Rubble

***Tytthosoceros lizardensis* Newman and Cannon 1996**

Type location: Heron Island, southern Great Barrier Reef, Australia.

Type specimen: Queensland Museum, Brisbane, Australia WM QM (G210716).

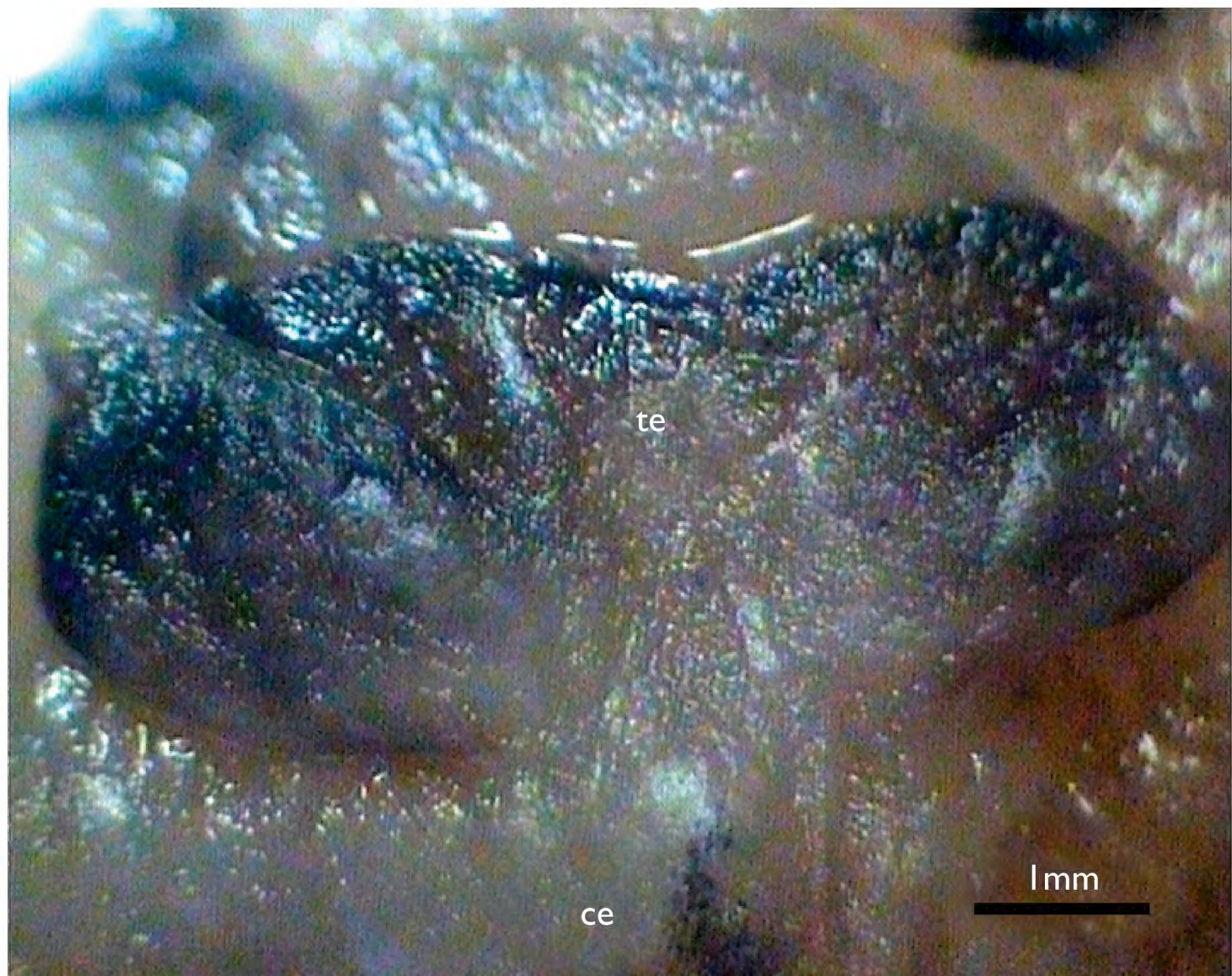
Specimens examined: ZUTC Platy 1001, 1002.

Fifty-six specimens of this species were collected from two locations (Stations No. 1 and 2, Fig. 1, Table 1). Most specimens were found in groups of up to 20 individuals,





**Figure 2.** Specimen of *Tytthosoceros lizzardensis* in vivo.



**Figure 3.** Ear-like pseudotentacle in *Tytthosoceros lizzardensis*: **te** pseudotentacular eyes **ce** cerebral eyes.



under rubble in intertidal pools, and on an orange sponge (*Clione vastifera*). Most specimens autolysed during sampling or fixation and only four specimens remained intact after fixation procedure. The following description is based on those four specimens.

**Description.** Sizes of specimens range from  $22 \times 38$  to  $30 \times 46$  mm; background color variable, mottled light brown or olive green with cream mottling composed of dots, forming loose transverse streaks medially and laterally, darker medially sometimes with a tinge of light brown medially and on the pseudotentacles; narrow marginal bands, black then grey interrupted with short white transverse streaks of microdots at rim; submargin narrow, either cream or transparent grey (Fig. 2); pseudotentacles ear-like, small, cream with mottling of light brown or olive between (Fig. 3); 70–80 cerebral eyes, arranged like a horseshoe, dorsal pseudotentacular eyes, scattered, with about 35 eyes (Figs 3 and 4); ventral surface of specimens cream with black rims, and very ruffled margins; anterior pharynx large and ruffled,  $1/5$  of the body length (8.6 mm), associated with 5–6 pairs of pharyngeal folds; mouth situated in the middle of the pharynx (Fig. 6C); intestine extending posteriorly, but not to the margin of the body; male and female gonopores posterior to pharynx, distinct sucker in mid-body proper (Fig. 5).

*Anatomy of Reproductive System* (Figs 6A, B, 7). Testes scattered throughout the body, vas deferens forming a network of thin tubes; single male copulatory apparatus with rounded-oblong seminal vesicle ( $456 \times 336 \mu\text{m}$ ), oval prostate oriented antero-dorsally ( $120 \times 96 \mu\text{m}$ ), deep male antrum ( $192 \mu\text{m}$ ), penis papilla with short stylet ( $120 \times 72 \mu\text{m}$ ); female copulatory apparatus with wide female atrium ( $120 \mu\text{m}$ ) and cement glands.

### ***Thysanozoon* sp.**

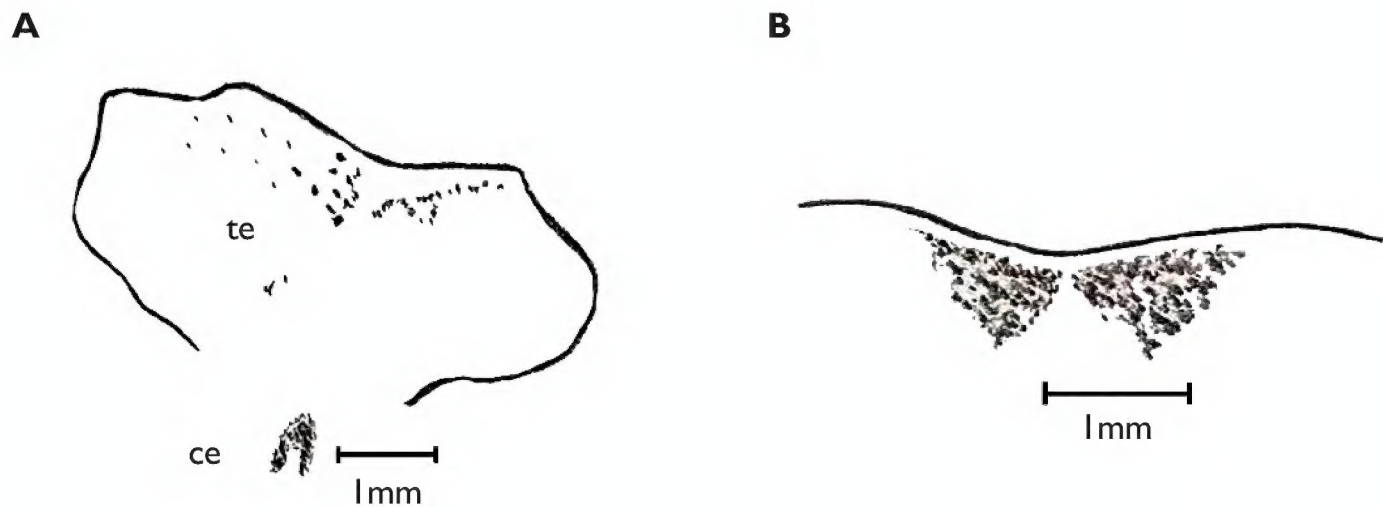
Specimens examined: ZUTC Platy 1003, 1004, 1005, 1006, 1007.

Specimens were found individually, under rubble and rocks, in intertidal pools (Fig. 8). Twenty-four specimens were collected from Stations No.1, 2 and 5 (Fig. 1, Table 1).

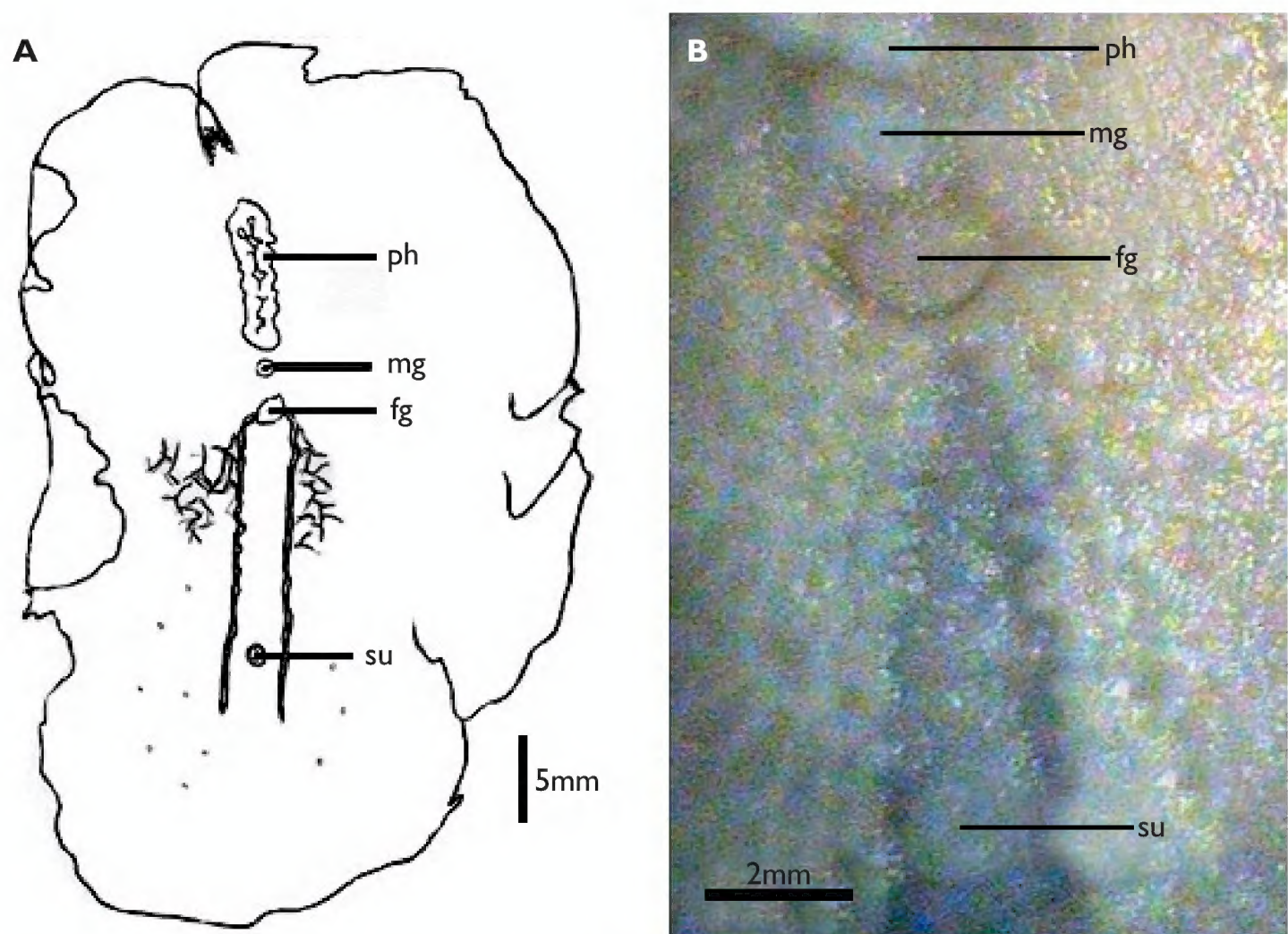
**Description.** Body sizes range from  $8 \times 12$  to  $22 \times 30$  mm; body translucent, red-white mottled with white spot and dots (Figs 8, 9); dorsal papillae red (Figs. 10, 11); pseudotentacles ear-like and small; cerebral eyes form a horseshoe-shaped cluster; dorsal and ventral pseudotentacular eyes present in clusters; pharynx elongated about  $1/5$  body length (3.86 mm) with 6 pharyngeal folds; two male gonopores and a single female gonopore are present; sucker posterior to the female gonopore, placed about mid-body (Fig. 12).

*Anatomy of Reproductive System* (Figs 13, 14). Testes and ovaries scattered throughout the body, doubled male copulatory apparatus posterior to the male gonopores; male gonopores situated directly after pharyngeal folds; male antrum short and wide ( $477 \times 378 \mu\text{m}$ ), with pointed stylet ( $387 \times 108 \mu\text{m}$ ); seminal vesicle oblong and muscular ( $387 \times 153 \mu\text{m}$ ); prostate oval ( $180 \times 90 \mu\text{m}$ ) with a thin wall; large female gonopore posterior to male gonopores, female antrum short and wide ( $288 \times 180 \mu\text{m}$ ) with cement glands.





**Figure 4.** Eye arrangements on pseudotentacle in *Tyttosoceros lizzardensis*: **A** dorsal surface: **te** pseudotentacular eyes **ce** cerebral eyes **B** ventral surface.

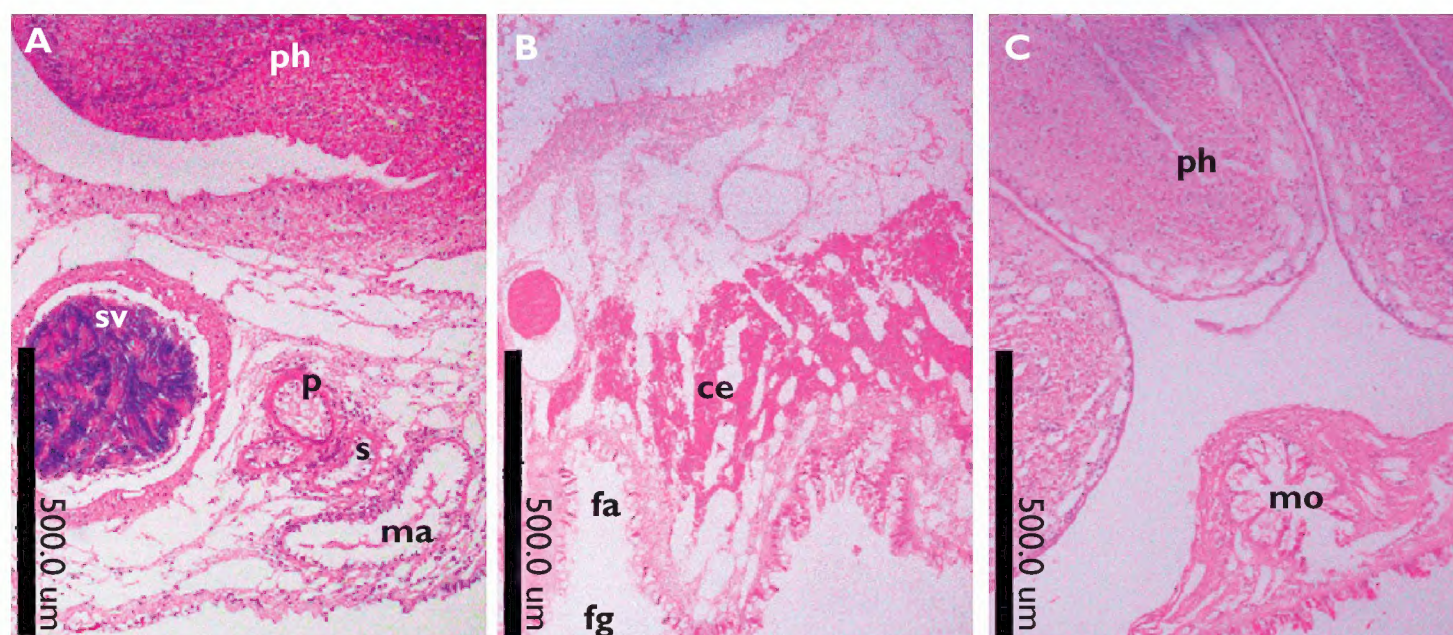


**Figure 5.** *Tyttosoceros lizzardensis*: **A** Drawing of the ventral surface **B** Photograph of the ventral surface **su** sucker **mg** male gonopore **fg** female gonopore **ph** pharynx.

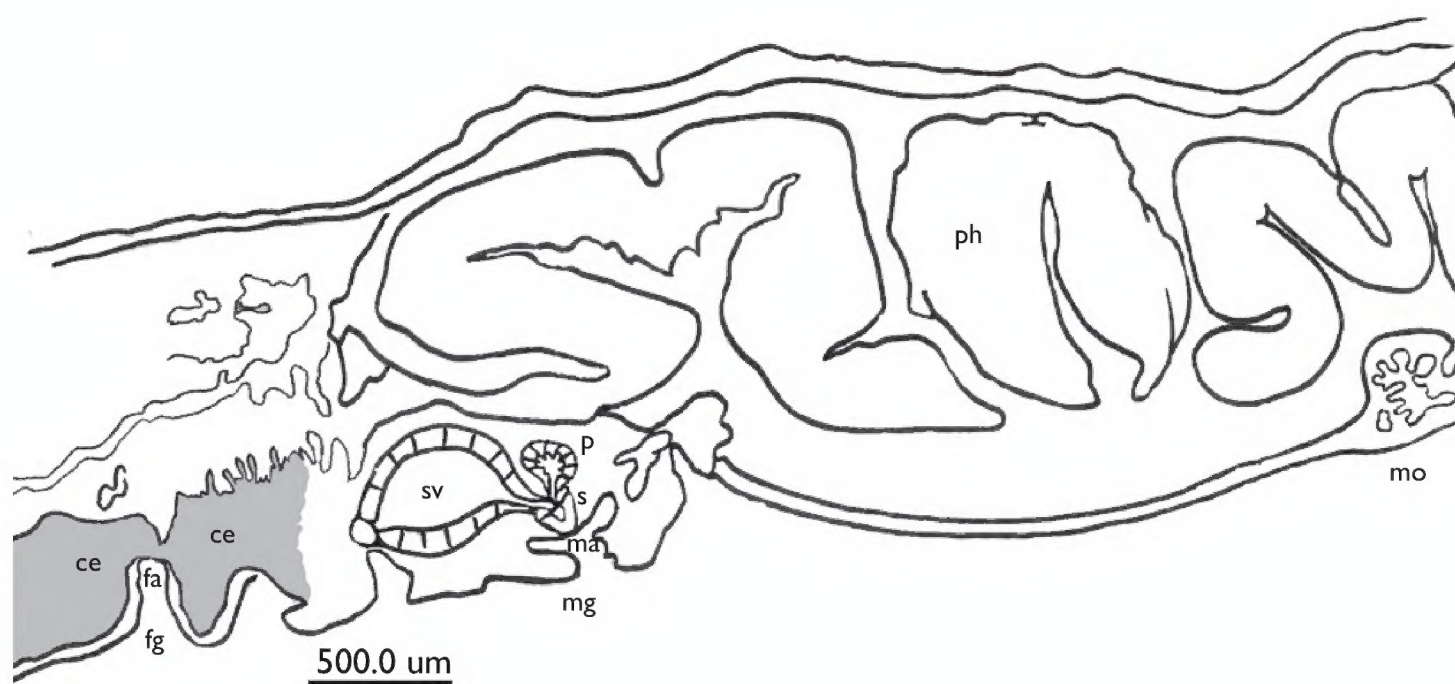
## Discussion

In the present study, 56 specimens of *Tyttosoceros lizzardensis* and 24 specimens of *Thysanozoon* sp. were found on the intertidal zones of the Qeshm Island, Persian Gulf. Identifications of the specimens are based on comparison of the specimens with im-





**Figure 6.** Sagittal section of *Tytthosoceros lizardensis*: **A** male copulatory system **B** female copulatory system **C** pharynx: **ma** male antrum **s** stylet **sv** seminal vesicle **p** prostate **fa** female antrum **fg** female gonopore **ce** cement gland **ph** pharynx **mo** mouth.

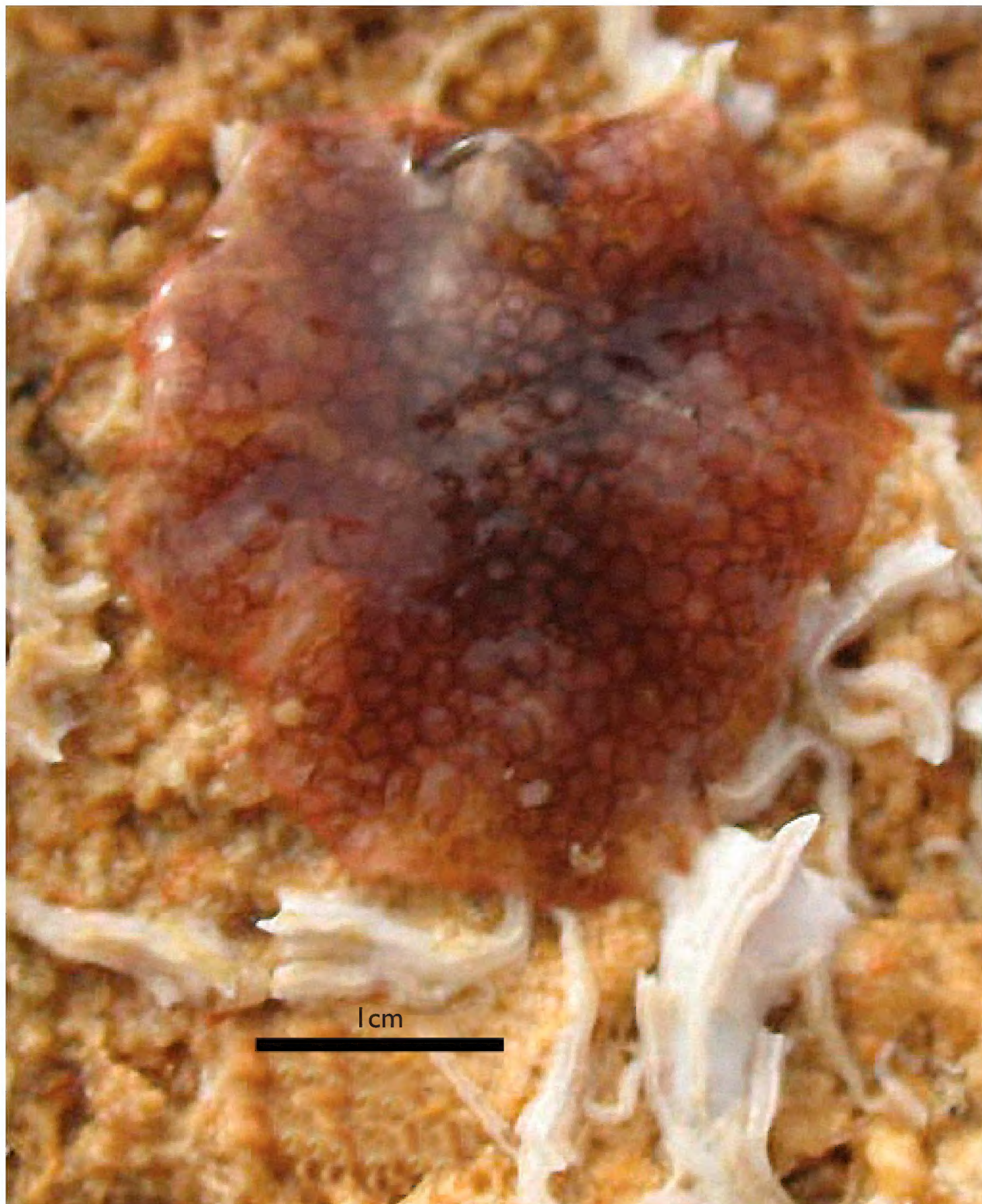


**Figure 7.** Sagittal reconstruction of *Tytthosoceros lizardensis*: **ma** male antrum **mg** male gonopore **s** stylet **sv** seminal vesicle **p** prostate **fa** female antrum **fg** female gonopore **ce** cement gland **ph** pharynx **mo** mouth

ages, the descriptions and keys of *Tytthosoceros lizardensis* and *Thysanozoon* sp. as provided by Newman and Cannon (1996, 2003).

Newman and Cannon (1994a, b, 1996a, b, 1997, 1998, 2000, 2002, and 2005) and Newman et al. (2003) supplied an overview over the family Pseudocerotidae in the Indo-Pacific region, particularly from Australia, Papua New Guinea and Micronesia, and reported numerous species. Here, the most specious genera are *Pseudoceros* and *Pseudobiceros*, but other genera like *Bulaceros* and *Tytthosoceros* have also been reported from the Great Barrier Reef, Australia, and Papua New Guinea.



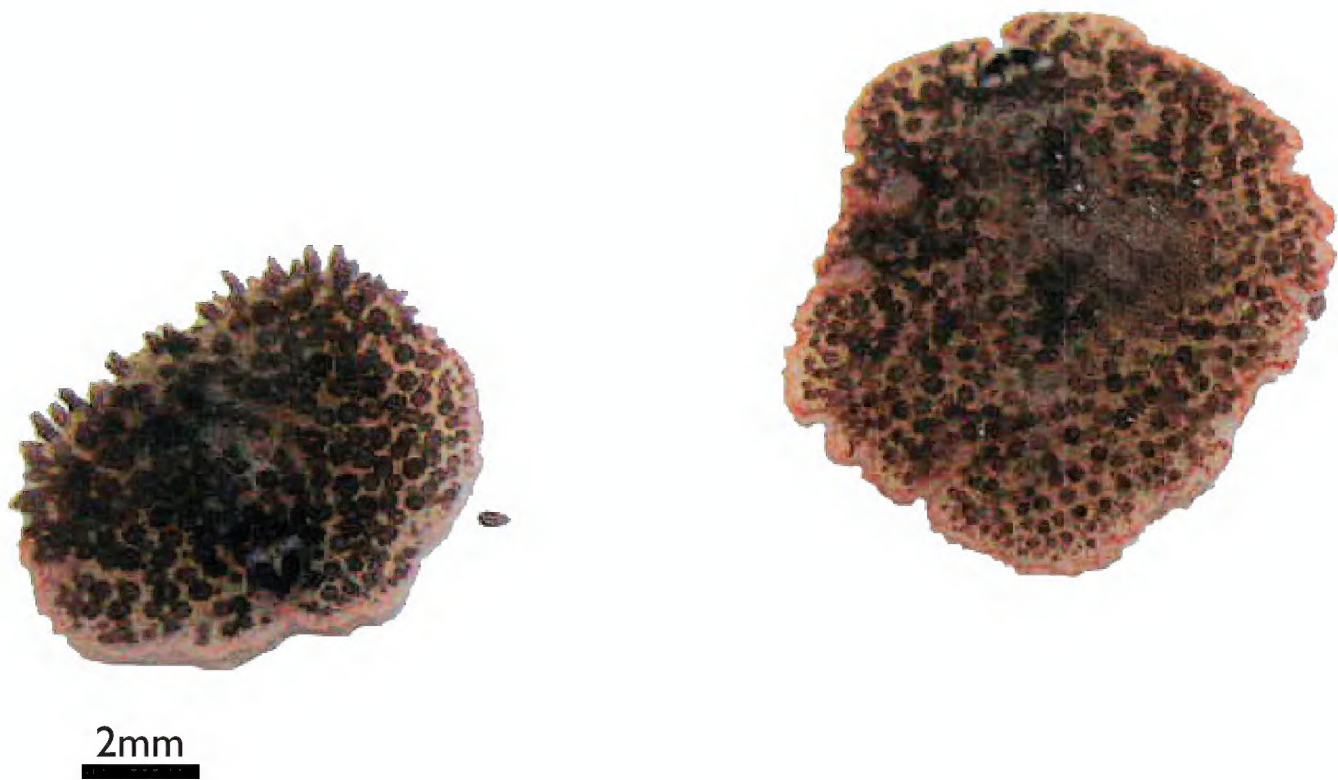


**Figure 8.** Live specimen of *Thysanozoon* sp.

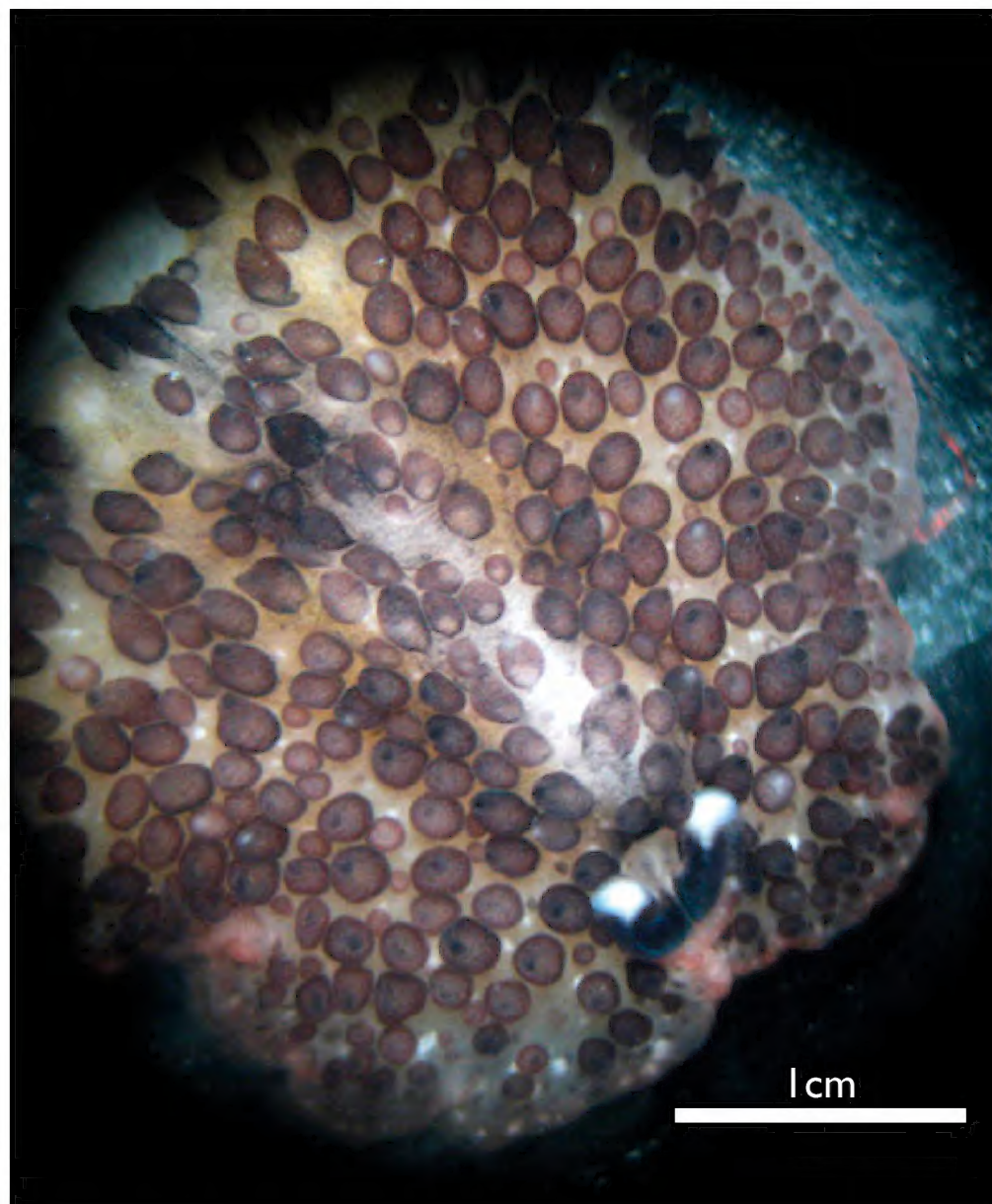
To facilitate identification of species, Newman and Cannon (1994) erected six groups defined by their respective colour pattern. Based on their specific color patterns, *Tytthosoceros lizardensis* and *Thysanozoon* sp. can be assigned to their group four, which contains species of cryptic coloration.

Because of their extremely fragile nature, only a few slides of sagittal sections were obtained, so the specimens of *Thysanozoon* could only be identified to genus level, but it might well turn out to represent a new species. Species of *Thysanozoon* are found circum-



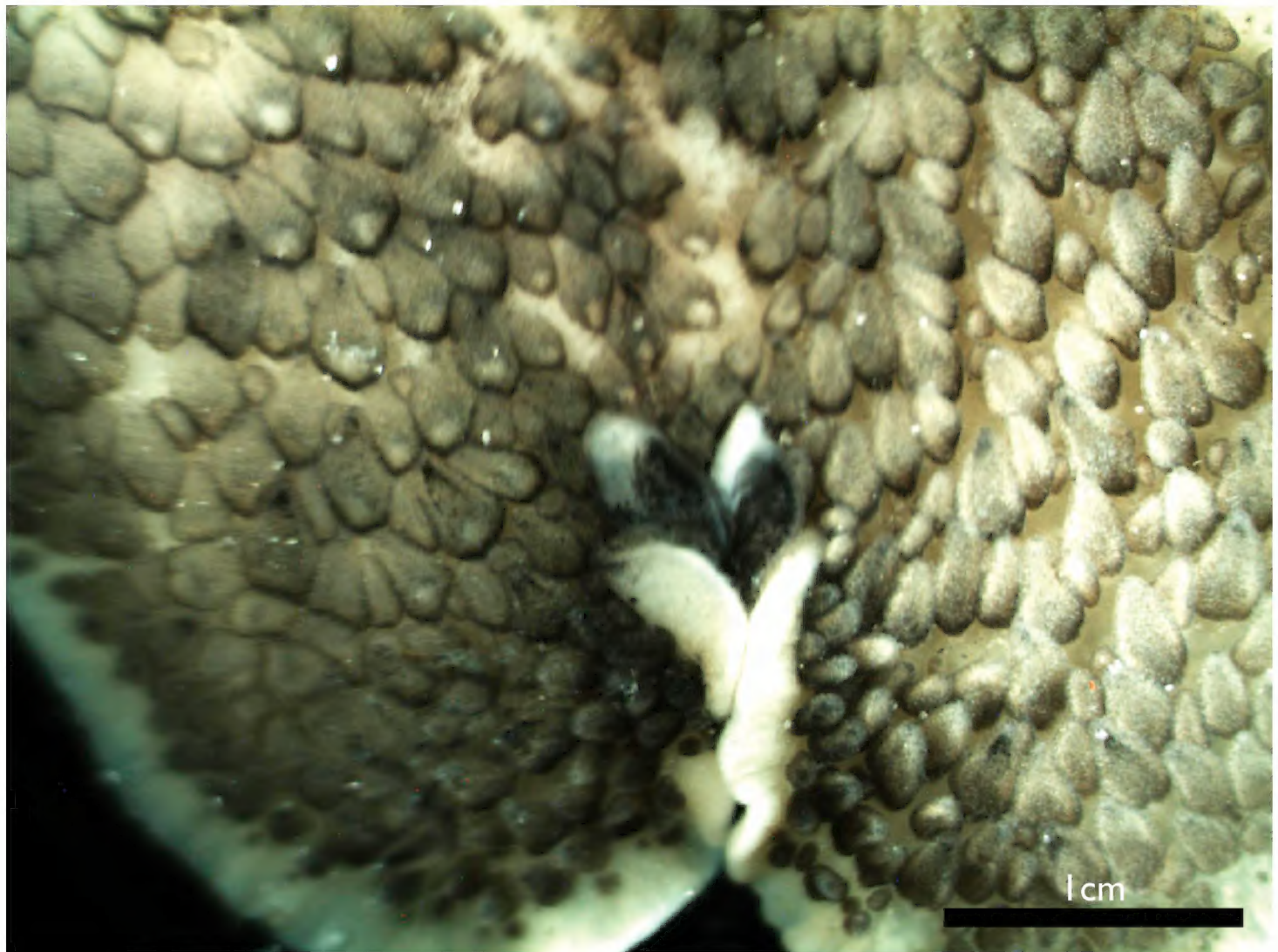


**Figure 9.** Live specimens of *Thysanozoon* sp. under laboratory conditions.

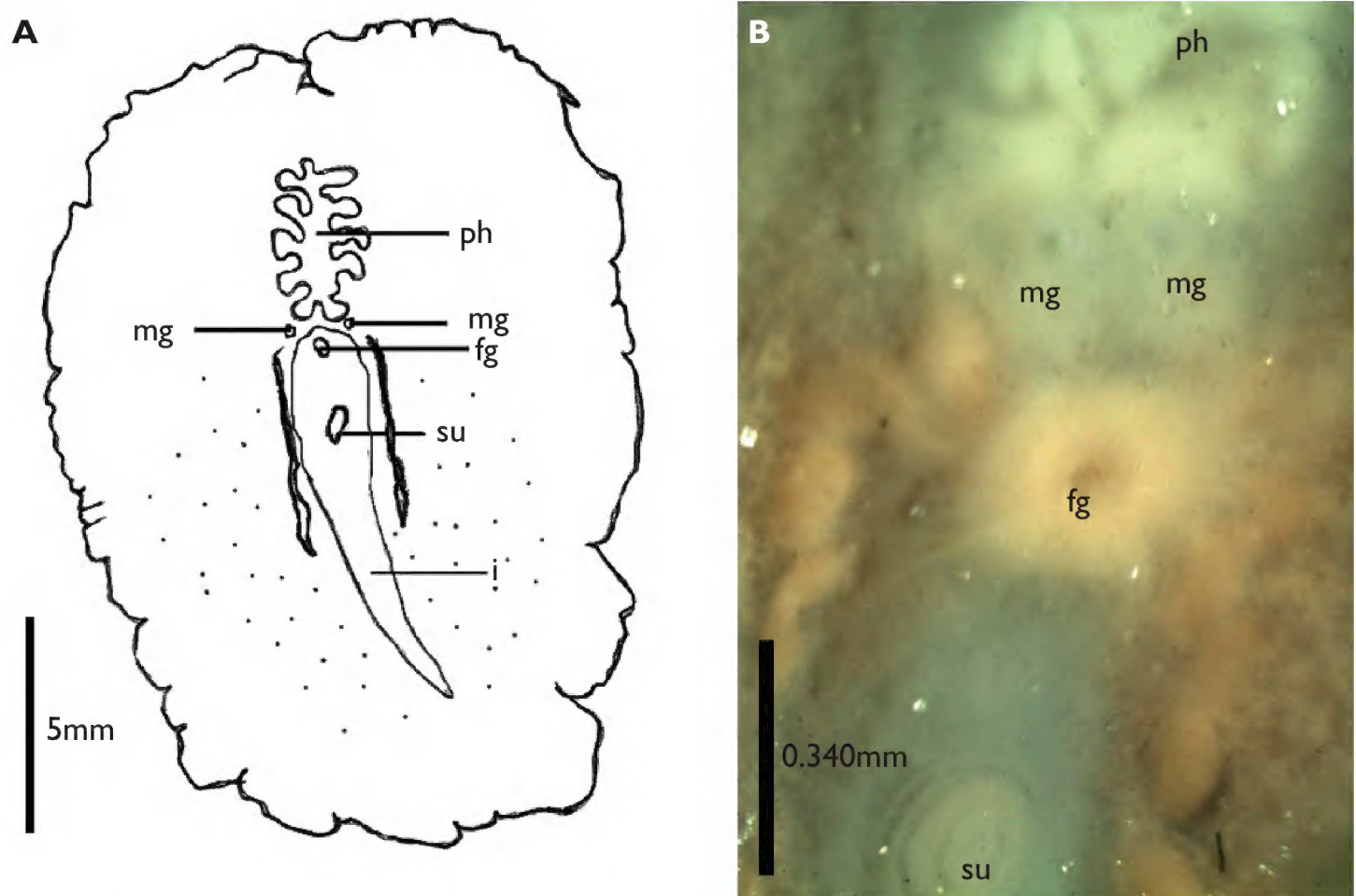


**Figure 10.** Dorsal view of *Thysanozoon* sp., showing papillae.



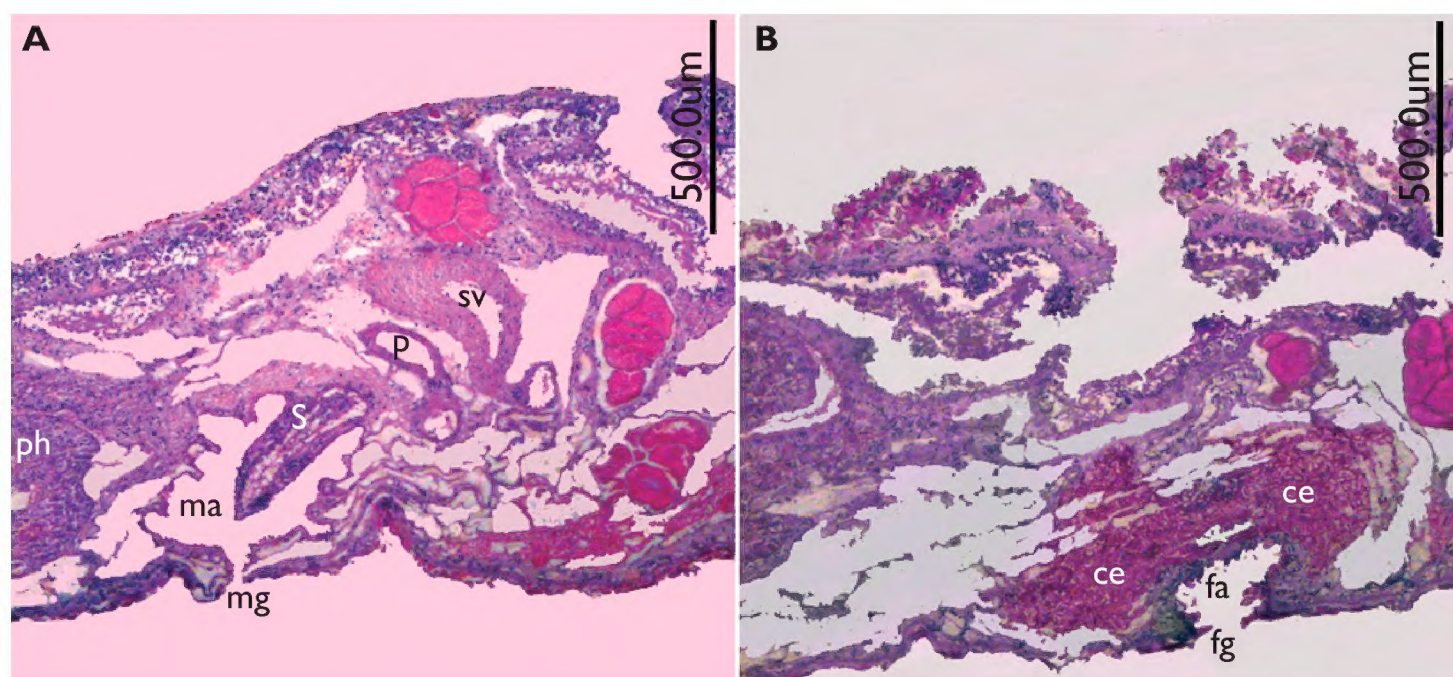


**Figure 11.** Dorsal papillae of fixed specimen of *Thysanozoon* sp., note distinctive papillae.

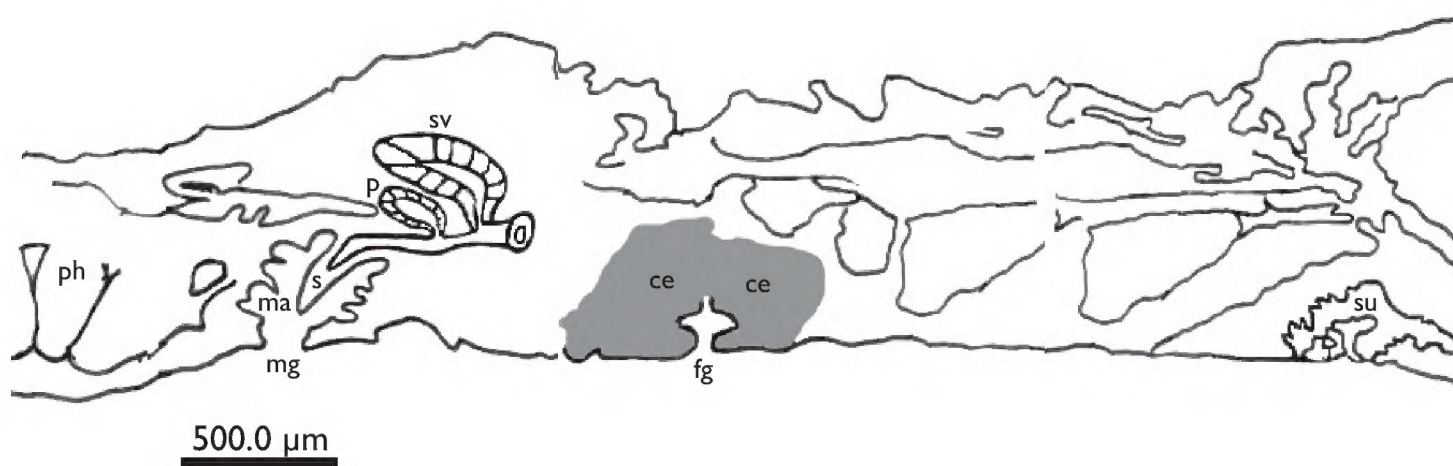


**Figure 12.** Drawing of ventral surface of *Thysanozoon* sp. **su** sucker **mg** male gonopore **fg** female gonopore **ph** pharynx **i** intestine.





**Figure 13.** Sagittal section of *Thysanozoon* sp.: **A** male copulatory system **B** female copulatory system **ma** male antrum **s** stylet **sv** seminal vesicle **p** prostate **fa** female antrum **fg** female gonopore **ce** cement glands **ph** pharynx.



**Figure 14.** Sagittal reconstruction of *Thysanozoon* sp.: **ma** male antrum **s** stylet **sv** seminal vesicle **p** prostate **fg** female gonopore **ce** cement glands **ph** pharynx **su** suker.

globally in warm seas, but those from Qeshm Island closely resemble those mentioned in the multimedia CD by Newman and Cannon (2005) as originating from the Red Sea.

The specimens of *T. lizardensis* found in the present study were similar to those mentioned in the same multimedia as being reported from Indonesia. As summarized in Table 2, the comparison of the specimens with the original descriptions of *T. lizardensis* showed some differences. However, these differences are not important enough to further separate the Persian Gulf specimens at the species level.

Specimens of *T. lizardensis* were only found at two locations in a rubble-rocky and rocky habitat. All specimens collected were associated with and possibly feed on an orange sponge (*Clione vastifera*). Although careful samplings were carried out six times, specimens of *T. lizardensis* were only found during one excursion in December 2007. This study only covered the intertidal zones, and it is very likely that further studies in the subtidal zone may reveal more species of *T. lizardensis* and of other species of flatworms.



**Table 2.** Differences of character states of *T. lizardensis* found in the present study and those in Newman and Cannon (1996).

Character	<i>T. lizardensis</i> (Newman & Cannon, 1996b)	<i>T. lizardensis</i> (present study)
Number of pharyngeal folds	5 pairs	5–6 pairs
Pseudotentacles	ear-like, erected	ear-like, small
Stylet	Short, 120 × 72 µm	Short, 110 × 70 µm
Prostate	Oval, 130 µm	Oval, 120 × 96 µm
Seminal vesicle	Oblong, 280 µm long	Rounded-oblong, 456 × 336 µm

## Acknowledgements

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